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Hidden Order and Dynamics of Supersymmetric VBS models

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We present a detailed analysis of properties of supersymmetric valence bond solid (VBS) states. The supersymmetric VBS states realize hole-doping into the well-known pure spin VBS (or AKLT) states and are known to possess (formal) similarity to the BCS wavefunction of superconductivity. By using a supersymmetric extension of matrix-product representation, we show that there is a kind of hidden order in our supersymmetric VBS states. With the supersymmetric matrix product formalism, hole-doping dependent behaviors of various physical quantities, such as the spin- and the charge excitation, the superconducting order parameter etc., are exactly evaluated. Several extensions of our VBS states will be discussed as well.